INSTRUCTION MANUAL

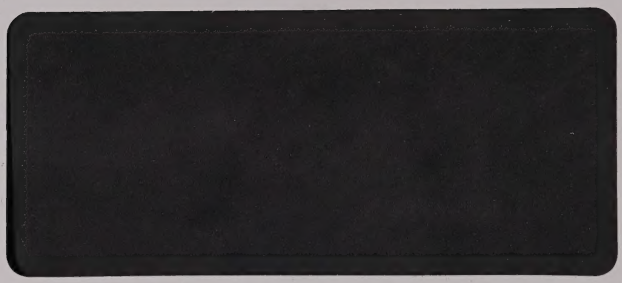
for

POWER SUPPLY MODULATOR

MODEL MO-5

WEINSCHEL ENGINEERING

GAITHERSBURG, MARYLAND



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POWER SUPPLY MODULATOR

MODEL MO-5

Manufactured by

WEINSCHEL ENGINEERING CO.
Gaithersburg, Maryland

IM #49
April 1963

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Weinschel Engineering warrants each instrument of its manufacture to be free from defects in material and workmanship. Our obligation under this warrant is limited to servicing or adjusting any instrument returned to our factory for that purpose, and to make good at our factory any part or parts thereof (except tubes, transistors, fuses, or batteries) which shall, within one year after making delivery to the original purchaser, be returned to us with transportation charges prepaid, and which on our examination shall disclose to our satisfaction to have been defective.

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Weinschel Engineering neither assumes nor authorizes any other person to assume for it any other liability in connection with the sale of its instruments and equipment.

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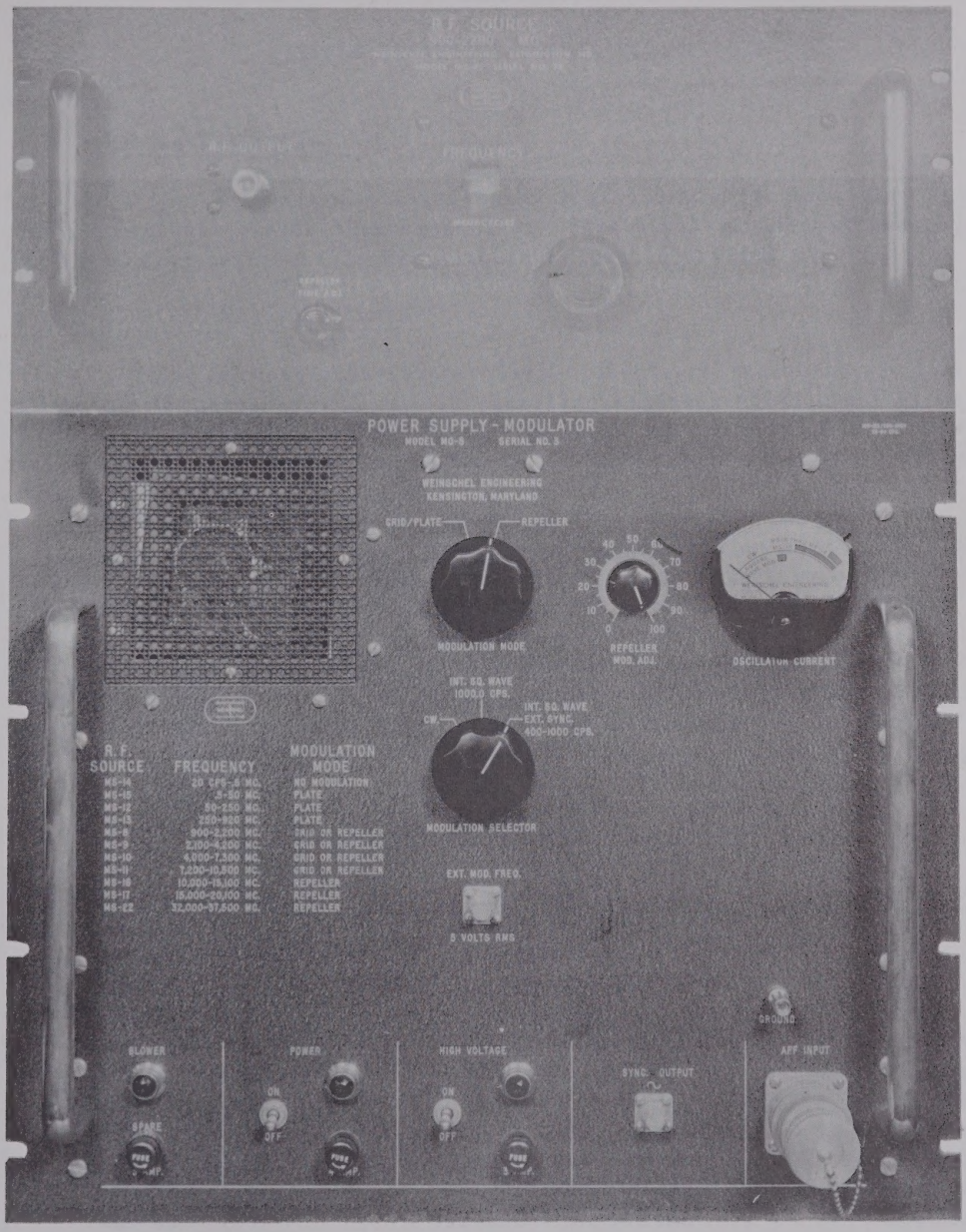


Figure 1.1. Power Supply Modulator, Model MO-5
(With RF Source, Not Supplied, Installed)

SECTION I

INTRODUCTION AND DESCRIPTION

1.1 SCOPE OF MANUAL

This instruction manual presents all information necessary to operate and maintain the Power Supply Modulator, Model MO-5, manufactured by Weinschel Engineering Co., Inc., Gaithersburg, Maryland.

1.2 PURPOSE OF EQUIPMENT

The purpose of the Power Supply Modulator, Model MO-5 is to provide all required operating voltages for Weinschel Engineering RF Sources listed in Table 1.1. The MO-5 is designed so that when the selected RF Source is installed, all required operating voltages are automatically set to the proper values.*

a. A modulation circuit operating either from an internal 1000.0 cps tuning fork or an external signal generator provides square wave plate grid or repeller modulation, depending on the requirements of the RF Source.

In addition, provision is made for automatic frequency follower operation of those sources operating in the frequency range above 900 mc.; consequently, the RF Sources and the MO-5 are compatible with the Model #VM-1 Standard Attenuator Comparator, manufactured by Weinschel Engineering.

TABLE 1.1
LIST OF RF SOURCES COMPATIBLE WITH MO-5

Weinschel Model No.	RF Range	Modulation Mode
MS-14	20 cps - .5 mc	None
MS-15	.5 - 50 mc	Plate
MS-12	50 - 250 mc	Plate
MS-13	250 - 920 mc	Plate
MS-8	900 - 2,200 mc	Grid/Repeller
MS-9	2,100 - 4,200 mc	Grid/Repeller
MS-10	4,000 - 7,300 mc	Grid/Repeller
MS-11	7,200 - 10,500 mc	Grid/Repeller
MS-16	10,000 - 15,100 mc	Repeller
MS-17	15,000 - 20,100 mc	Repeller
MS-22	32,000 - 37,000 mc	Repeller

*In the case of the MS-12 and MS-13 be sure that the switch on top of the source is in the MO-5 position.

TABLE 1.2

ELECTRICAL AND MECHANICAL SPECIFICATIONS

Electrical Compatibility	See Table 1.3 for detailed electrical specifications. Supplies all operating voltages and modulation signals, within tolerances, required by the Weinschel Engineering RF Sources listed in Table 1.1.
Mechanical Compatibility	Compatible with all RF Sources listed in Table 1.1 to enable mounting the Sources in the MO-5.
Cooling Air Compatibility	Automatically supplies cooling air to all RF Sources listed in Table 1.1, except for MS-13, MS-14, MS-15, and MS-22, which do not require forced air cooling.
Automatic Frequency Follower Action	Provision is made, when used with the Model VM-1 Standard Attenuator Comparator, for automatic frequency follower action.
Modulation Capability	See Table 1.3. Internal square wave generator triggered by either an internal 1000.0 cps tuning fork oscillator (frequency stability better than 0.05% - 40°C. to +85°C. and over a 10% line voltage variation) or an external signal generator with an output of 5v rms 400 - 10,000 cps. CW operation is also available.
Power Requirements	115/220v ac ±10%, 50 - 60 cps, 350 volt amperes.
Dimensions	Height: 25 inches (with RF Source mounted) Width: 19 inches Depth: 17 inches
Mounting	Mounts in standard 19-inch relay rack.
Weight	75 lbs. (approx.)

1.3 DESCRIPTION OF EQUIPMENT (Figure 1.1)

Power Supply Modulator, Model MO-5 is a self-contained unit designed to mount in a standard 19" relay rack. All operating controls are mounted on the front panel and are identified by engraved markings. The top of the unit contains a set of slides which enables easy insertion of the various RF Sources.

When the RF Source is installed, electrical connections are made automatically by means of three connectors which mate with corresponding connectors mounted on the rear of the RF Source. With the exception of the MS-22 which utilizes all three connectors, all RF Sources use only two of the three connectors.

Electrically, the MO-5 consists of three stable and well-regulated power supplies employing conventional vacuum tubes. Because a wide variety of operating voltages are required by the RF Sources, provision is made so that merely plugging the RF Source into the MO-5 automatically applies output voltages at the proper levels for that particular source.

When an RF Source requiring cooling air is plugged into the MO-5, cooling air is automatically supplied by a blower mounted in the power supply.

To avoid damaging the RF Sources, application of high voltage is delayed approximately two minutes after the source is plugged in or power is applied to the MO-5.

Internal modulation circuits provide plate grid or repeller square wave modulation from either an internal 1000.0 cps $\pm$.01% tuning fork oscillator or any external generator having a 5v rms output signal in the frequency range between 400 - 10,000 cps.

Refer to table 1.2 for complete electrical and mechanical specifications.

TABLE 1.3
DETAILED ELECTRICAL SPECIFICATIONS

	RF Plug-In Source	Voltage	Supply Connection	Max. Current	Regulation			
					Short Time 2 min	± 10% Line V. Var.	Long Time 2 hrs	Ripple and Noise
Beam Supply	MS-12 MS-13 MS-14 MS-15	⁄325v dc	Negative side connected to chassis (ground)	40ma	<0.02%	<1.0%	<0.3%	6mv rms
	MS-8 MS-9	-325v dc	Positive side connected to chassis (ground)	18ma	<0.01%	<0.1%	< 0.3%	4mv rms
	MS-10	-1000v dc	Positive side connected to chassis (ground)	20ma	<0.01%	<0.05%	< 0.3%	4mv rms
	MS-11	-1250v dc	Positive side connected to chassis (ground)	20ma	<0.02%	<0.05%	<0.3%	3mv rms
	MS-16	-1000v dc	Positive side connected to chassis (ground)	40ma	<0.01%	<0.05%	<0.3%	4mv rms
	MS-17	-1000v dc	Positive side connected to chassis (ground)	40ma	<0.01%	<0.05%	<0.3%	4mv rms

TABLE 1.3 (Cont'd)

	RF Plug-In Source	Voltage	Supply Connection	Max. Current	Regulation			
					Short Time 2 min	± 10% Line V. Var	Long Time 2 hrs	Ripple and Noise
	MS-34	-2050v dc	Positive side connected to chassis (ground)	12.5ma	<0.05%	<0.05%	<0.3%	<4mv rms
Repeller Supply	MS-8, 9, 10, 11, 16, 17, 34	-600v dc	Positive side connected to negative side of beam supply	3ma	<0.01%	<0.05%	<0.3%	<3mv rms
Filament Supply	MS-8, 9, 10, 11, 14, 15, 16, 17, 34	⨍6.3v dc	Negative side connected to negative side of beam supply	0-2 Amp	<1.5%	<1.5%	<2%	<0.5mv rms
Modulator Supply and Grid Supply	MS-12, 13 & 15	⨍380v dc	Negative side connected to chassis (ground)	35ma	<0.1%	<0.1%	<0.3%	<2mv rms
	MS-8, 9, 10, 11	380v dc	Negative side 275v neg. with respect to neg. side of beam supply	35ma for mod supply; 12ma for grid supply	<0.1% for mod supply; <0.15% for grid supply	<0.1% for mod supply; <0.15% for grid supply	<0.3%	<2mv rms for mod. supply; <4mv rms for grid supply

TABLE 1.3 (Cont'd)

RF Plug-In Source	Voltage	Supply Connection	Max. Current	Regulation			
				Short Time 2 min	± 10% Line V. Var	Long Time 2 hrs	Ripple and Noise
MS-34	-380v dc	Positive side connected to negative side of beam supply	0-60ma	<0.1% for mod supply; <0.01% for grid supply	<0.1% for mod supply; <0.01% for grid supply	<0.3%	<3mv rms for mod supply; <1mv rms for grid supply

Modulator

MS-14 Modulation type: CW

MS-12, 13, 15 Modulation type: Plate modulation. 100% square wave. Peak-to-peak voltage of modulated plate voltage: 280v min.

MS-8, 9, 10, 11 Modulation type: either grid or repeller modulation; 100% square wave. Type of modulation is selected by front panel mounted switch. Peak-to-peak voltage of modulation signal. 200v min. for grid modulation.

MS-8, 9, 10, 11, 16, 17, 22 Modulation type: Repeller modulation, 100% square wave. Peak-to-peak voltage of modulation signal: 90v min.

Frequency range of modulator: Internal: 1000.0 cps ± .5 cps. Frequency stability of internal modulator: ± .1 cps (tuning fork osc.)
External: 400 cps - 10,000 cps

Grid modulation: Rise time <4 μ sec; Decay time <4 μ sec

1.4 EQUIPMENT SUPPLIED

Refer to Table 1.4 for a list of equipment and accessories supplied with the Model MO-5.

TABLE 1.4

EQUIPMENT AND ACCESSORIES SUPPLIED

Description	Quantity
Power Supply Modulator, Model MO-5	1
A. C. Power Cord	1
Adapter for AFF INPUT Connector containing an 82,000 ohm, 2 w. resistor	1
Cable for use with Automatic Frequency Follower (if required)	1
Jumper Plug for J2	1
Instruction Manual	1

1.5 TEST EQUIPMENT REQUIRED

The test equipment listed in table 1.5 is required to maintain the Model MO-5.

TABLE 1.5

TEST EQUIPMENT REQUIRED

Description	Quantity
Vacuum Tube Voltmeter, 20,000 ohm/volt	1
A. C. Vacuum Tube Voltmeter, Electronics Instruments Co., Inc., Model 347 or equal	1
Oscilloscope, Tektronics, Inc., Type 543 or equal	1
Adjustable output A. C. transformer with A. C. Voltmeter	1
Voltage divider for A. C. Ripple Measurements (construct per figure 5.5)	1
Test Plugs: One set of 2 special plugs for each RF Source except MS-16 and MS-17, listed in Table 1.1, plus 1 plug (mates with J2) for MS-22 (May be purchased from Weinschel Engineering or manufactured locally.) See figure 5.7.	1 set

SECTION II

PREPARATION FOR USE

2.1 UNPACKING

Exercise normal care when removing the instrument and packing material from the shipping container. Refer to table 1.4 for the list of accessories packed with the equipment.

Examine the instrument for physical damage. Notify the shipping company immediately if evidence of damage is found. If shipped f. o. b. Gaithersburg, Maryland, damage claims must be initiated by the consignee. If damage has occurred, retain all cartons and packing material until an agent of the carrier has examined them. Do not return the instrument to Weinschel Engineering until the claim for damage has been established.

2.2 PREPARATION FOR USE

a. Make certain that all tubes are firmly seated and locked in place.

b. Check the primary power source for voltage.

c. For 115v 50 - 60 cycle operation be certain that terminals 1 and 2 are shorted together as well as terminals 3 and 4 of the terminal boards (located underneath the bottom chassis) associated with transformers T1 and T2.

NOTE

Instrument is shipped connected for 115v ac. See tag attached to instrument.

e. For operation from 220v 50 - 60 cps, make sure that only terminals 2 and 3 of each of the two terminal boards are shorted together. Change the tag on the instrument to indicate 220v connections.

The equipment is now ready for operation.

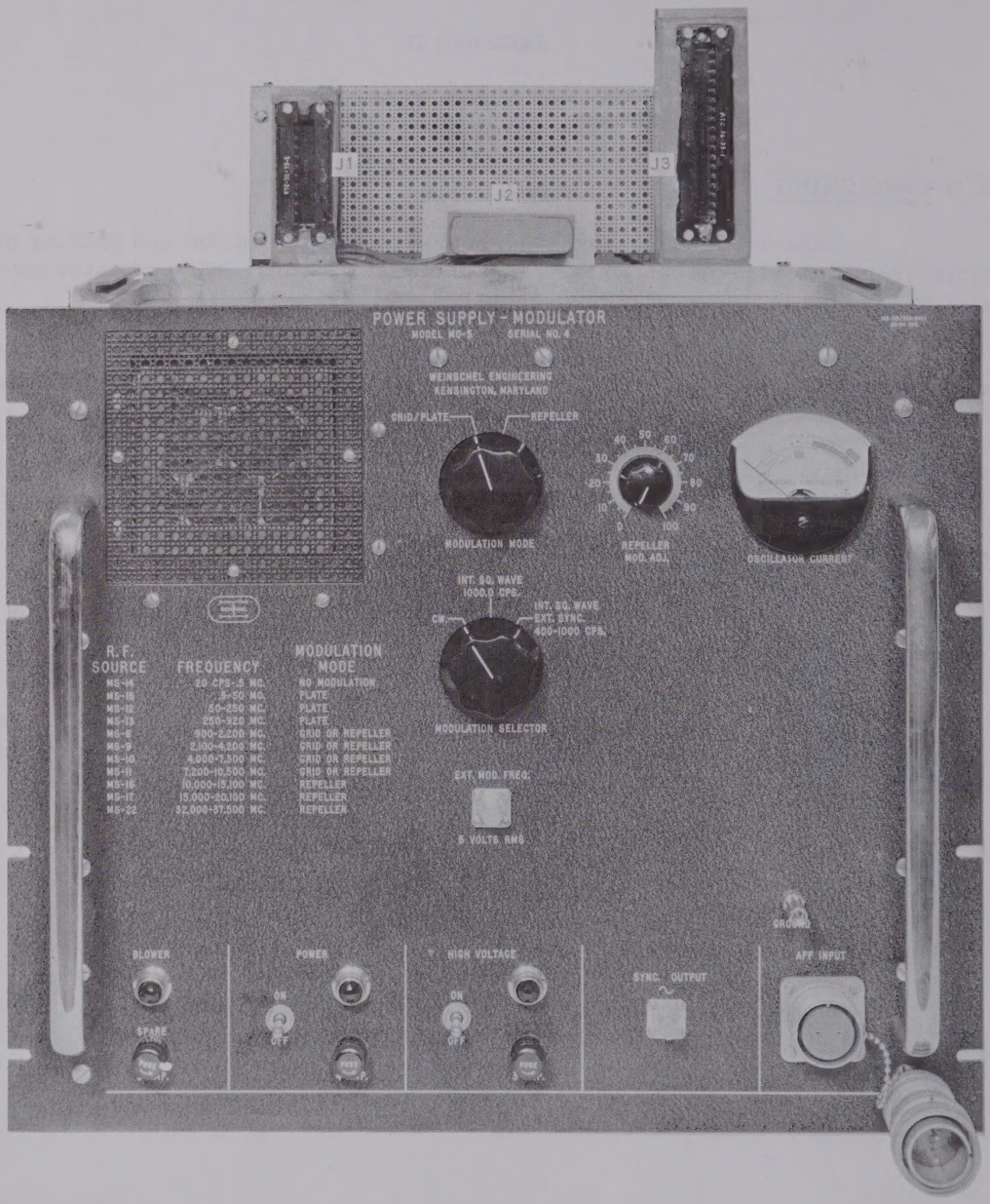


Figure 3.1. Operating Controls, Model MO-5

SECTION III

OPERATING INSTRUCTIONS

3.1 INSTALLATION

The MO-5 may be installed in a standard 19-inch relay rack or used on the bench. When mounting the instrument in the relay rack, be certain that there is sufficient room above the MO-5 so that the RF Sources can be readily inserted. In addition, be certain that the cooling air outlet of the RF Source is not obstructed.

3.2 OPERATING PROCEDURE

Refer to table 3.1 for a list of controls and indicators and their function.

3.2.1 CONNECTIONS

a. When utilizing RF Sources other than the MS-22, be certain that the shorting plug furnished with J2 is installed. When it is desired to operate the MS-22 unit, the shorting plug must be removed from J2, which is located between the 20 and 36-pin connectors on the vertical chassis at the top of the MO-5.

b. When the Model MO-5 is used in conjunction with the Model VM-1 Standard Attenuator Comparator and AFF operation is required, connect the AFF cable to the VM-1 and to the AFF input connector after removing the adapter containing the 82 k ohm resistor.

CAUTION

When the Model VM-1, Standard Attenuator Comparator is not used, be certain that the plug containing an 82 k ohm resistor is installed in the AFF input connector.

c. If it is desired to modulate the RF Source at a frequency other than 1 kc, connect the external signal generator output to the EXT. MOD. FREQ. connector on the front panel of the MO-5. For stable, square wave modulation, the applied signal must be 5v rms and within the frequency range of 400 to 10,000 cps.

3. 2. 2. OPERATION

CAUTION

Before removing or inserting RF Sources, be certain that the POWER switch is in the OFF position. This procedure avoids damaging J1, J2, and J3.

a. Insert the selected RF Source into the slides and connectors at the top of the MO-5.

b. Set the POWER switch to the ON position. The indicator should be lit.

c. Refer to the modulation chart engraved on the front panel of the MO-5 and set the MODULATION MODE switch to the position appropriate for the RF Source in use.

d. Determine the type of modulation (cw or square wave) desired and set the MODULATION SELECTOR switch to the proper position.

e. Set the HIGH VOLTAGE switch to the ON position. Provided that the main power switch has been on for at least two minutes, the high voltage indicator should be lit. Before operating the RF Source, allow an additional 5 minutes warm-up time.

f. The oscillator current, as observed on the front panel meter, should be within the range shown on the meter face for the RF Source in use.

g. If repeller modulation is employed, adjust the modulation level by means of the REPELLER MOD. ADJ. control.

h. Operate the RF Source in accordance with the instruction book furnished with the particular source.

CAUTION

Before removing or inserting RF Sources, be certain that the POWER switch is in the OFF position.

TABLE 3.1

OPERATING CONTROLS, INDICATORS AND CONNECTORS

Control/Indicator/Connector	Reference Symbol No.	Description
POWER: ON-OFF Switch	SW2	Controls application of primary power.
Indicator (Red)	DS1	When lit, indicates MO-5 is on.
Fuse	F1	Protects against overload.
HIGH VOLTAGE: ON-OFF	SW3	Controls application of repeller and beam power to RF Source. Time delay of 2 minutes after POWER switch is turned ON prevents damage to RF Source.
Indicator (Red)	DS2	When lit, indicates repeller and beam power is supplied to RF Source.
Fuse	F2	Protects against overload of T1.
BLOWER: Indicator (Red)	DS3	When lit, indicates cooling air being supplied to RF Source.
Spare Fuse	--	Mounts spare fuse.
SYNC. OUTPUT	J5	Supplies sine wave modulation synchronizing signal for external equipment. Active for both internally and externally generated modulating signals.
AFF INPUT	J6	When used with Model VM-1 Standard Attenuator Comparator, AFF cable is connected between J6 and AFF output of VM-1. When AFF is not used, the adapter with 82k ohm resistor must be connected to J6.
GROUND	--	Provides common grounding point for external equipment.

Control/Indicator/Connector	Reference Symbol No.	Description
EXT. MOD. FREQ.	J4	Enables connection of external sine wave source to control modulation frequency. Input signal must be 5v rms and within frequency range of 400 to 10,000 cps.
MODULATION SELECTOR	SW5	Controls type of modulation, either cw or internal or external synchronizing modulation signal.
MODULATION MODE	SW4	Selects either grid/plate or repeller modulation of the RF Source.
REPELLER MOD. ADJ.	P1	Controls modulation level of the RF Source repeller.
OSCILLATOR CURRENT	M1	Meter indicates oscillator current. Scale marked for correct range of current for each RF Source.
20-Pin Connector	J1	Mates with 20-pin connector on RF Sources and enables application of correct high voltage ac to beam supply rectifiers.
12-Pin Connector	J2	Mates with connector on rear of MS-22 only and partially controls application of high voltage ac to beam supply rectifiers. When MS-22 is not used, the shorting adapter plug must be installed.
36-Pin Connector	J3	Mates with 36-pin connector on RF Sources and provides electrical connections to be made.

SECTION IV

THEORY OF OPERATION

4.1 GENERAL (Figures 4.1 and 5.6)

The Power Supply Modulator, Model MO-5 is comprised of five major functional circuits, as shown in the simplified block diagram. Each of the functions is discussed below.

4.2 CONTROL CIRCUITRY

The Model MO-5 is designed so that the power supply voltage control circuits are completed through the RF Source. Consequently, the RF Source itself controls the voltages applied to it. To facilitate maintenance, a set of test plugs is available (or may be manufactured locally) which simulate the voltage controlling functions of the various RF Sources. All operating voltages and controlling functions are provided through three multi-pin connectors, J1, J2 and J3, which mate with corresponding plugs mounted on the rear of the RF Sources. To ascertain the exact operation of the MO-5 with a particular RF Source, it is necessary to correlate the schematic diagram of the MO-5 with the schematic of the particular RF Source of interest. Simplified operation of the equipment may be determined by correlating the simplified block diagram with the schematic of the particular RF Source.

4.3 BEAM POWER SUPPLY

The beam power supply consists of a full-wave rectifier, the output of which is regulated by V3, which is under the control of voltage regulators V4 through V11.

The dc output of the system is also controlled by changing the high voltage ac input to the rectifiers. The particular ac plate voltage is applied through J1 and J2 to V1 and V2 and the value selected is controlled by jumpers in the RF Source under operation. For all RF Sources except MS-22, a standard jumper plug is installed in J2. When the MS-22 is operated, the standard plug is removed and the MS-22 connector mating the J2 applies 2,500v ac to V1 and V2.

Control of the regulator circuit is accomplished by feedback voltage set by either P4, P5, or P6, depending on the RF Source which is installed.

Note that screen voltage for V3 is developed by a floating, regulated dc supply consisting of a full-wave bridge rectifier (CR3 through CR6) and zener diode CR7.

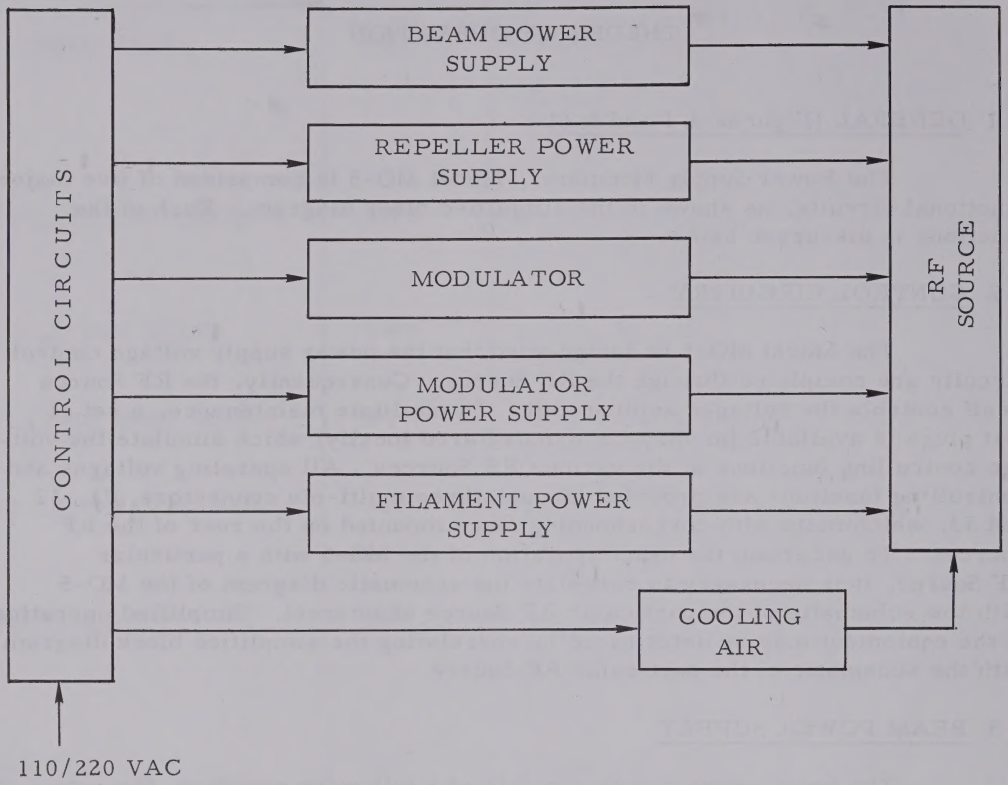


Figure 4.1. Block Diagram, Model MO-5

4.4 REPELLER POWER SUPPLY

The repeller power supply consists of a full-wave rectifier, the output of which is regulated by V13 through V16 and CR1. The output voltage is set at 600v by means of P7. Note that the positive output is connected to the negative side of the beam supply.

4.5 MODULATOR POWER SUPPLY

The modulator power supply is similar to the repeller supply. The dc output is, however, used by both the MO-5 modulator system and the RF Source under operation.

4.6 FILAMENT POWER SUPPLY

To enable stable operation of the RF Sources, regulated 6.8v dc is supplied as filament operating power. For RF Sources MS-12 and MS-13, which contain an integral filament transformer, 115v ac is supplied to the unit through pins 1 and 3 of J1.

4.7 MODULATOR

The modulator system contains a flip-flop square wave generator which may be driven at any frequency between 400 and 10,000 cps. Symmetry of the square wave output is controlled by P2. The square wave output is amplified by V26 (gain is controlled by changing B+) and V27. The output of V27 may be used to modulate either the grid plate or repeller, depending on the position of SW4. For repeller modulation, the amplitude is controlled by REPELLER MOD. ADJ. potentiometer P1 and applied to V29 which provides the modulating signal.

The driving signal for the flip-flop square wave generator is obtained either from an external signal generator or the stable internal 1000.0 cps tuning fork oscillator. The sine wave outputs of the oscillator are clipped and differentiated by V24B.

If cw operation is desired, the MODULATION SELECTOR switch may be set to CW. In this position of the switch, section B (SW5) effectively disables the flip-flop.

A sine wave synchronizing signal, for use by external equipment, is applied to SYNC. OUTPUT connector J5 from cathode follower V24A.

4.8 COOLING AIR

All RF Sources except the MS-12, MS-13, MS-14, MS-15, and MS-22 require cooling air during operation. When the Source is installed in the MO-5, pins 2 and 4 of J1 complete the blower motor circuit. The blower thus supplies filtered room temperature cooling air through a duct which mates with the air duct in the RF Source.

SECTION V

MAINTENANCE INSTRUCTIONS

5.1 GENERAL

The Model MO-5 is designed to require a minimum of maintenance. No special tools or test equipment other than those listed in Table 1.4 are required to service the instrument. Instructions for setting all chassis mounted controls are given in this section of the manual. In addition, minimum performance test procedures are set forth in order to ascertain that the equipment is operating within design specifications.

5.2 PERFORMANCE TEST AND ADJUSTMENT PROCEDURES

Employ the following procedures to ascertain that the equipment is operating within specifications and to adjust the instrument after servicing. During the following tests, the ac ripple and noise components are measured for acceptable levels. Regulation of the dc output voltages will not, however, be checked because of the necessity of using special laboratory-calibrated test equipment. Procedures for utilizing such laboratory equipment are, however, given in Paragraph 5.3.

Test plugs utilized in the following procedures may be either purchased from Weinschel Engineering or manufactured locally, utilizing information contained in figure 5.7.

To enable ac ripple measurements to be made, the test circuit voltage divider shown in figure 5.5 must be assembled. The circuit may be constructed by mounting the resistors on the 2 mfd 2,000 volt capacitor. Use clip leads for making connections to chassis ground and to the input voltage.

Before proceeding with the following adjustments, connect the Model MO-5 to the output of a variable line voltage transformer capable of adjusting the ac output between 105 and 130v ac. Install an ac voltmeter across the output of the variable transformer.

5.2.1. TEST AND ADJUSTMENT PROCEDURES UTILIZING MS-8 TEST PLUGS

Be certain that the ac power is turned off and install the MS-8 test plugs in J1 and J3. Be certain that the normal jumper plug is installed in J2.

a. Beam Power Supply Adjustments and Tests. Connect the dc voltmeter between pin 25 (-) of the test plug inserted in J3 and chassis ground (+). Turn on the POWER and HIGH VOLTAGE switches. Adjust the ac input

voltage to 115v. After the high voltage power comes on, adjust potentiometer P4 for a meter reading of -325v. Vary the line voltage between 105 and 130v. There should be no discernible movement of the dc meter pointer. Disconnect the dc voltmeter and connect the ac voltmeter at the same points. Set the ac line voltage at 105, 115 and 130v and measure the ac ripple. Ripple voltage should be less than 4mv rms. Disconnect the ac voltmeter.

b. Modulator Power Supply Adjustments and Tests. Connect the dc voltmeter between pin 20 (-) and 34 (+) of the test connector inserted in J3. Be certain that the MODULATION MODE switch is set to GRID/PLATE position and the MODULATION SELECTOR switch is set to the CW position. Adjust potentiometer P3 for a meter reading of +380v dc. Vary the ac input between 105 and 130v. There should be no discernible movement of the meter pointer. Next, substitute the ac voltmeter for the dc voltmeter and measure the ripple and noise components at line voltages of 105, 115 and 130v. Ripple should be less than 2mv rms. Disconnect the voltmeter.

c. Repeller Power Supply Adjustments and Tests. Set the MODULATION MODE switch to the GRID/PLATE position and the MODULATION SELECTOR switch to the CW position. Connect the dc voltmeter between pin 25 (+) and pin 5 (-) of the test connector inserted in J3. Adjust potentiometer P7 for a meter reading of -600v dc. Vary the ac line voltage between 105 and 130v. There should be no discernible movement of the dc meter pointer. Replace the dc voltmeter with the ac voltmeter and measure the ripple component at line voltages of 105, 115 and 130 volts. Ripple should be less than 3 mv rms. Disconnect the ac voltmeter.

d. Modulator Circuit Adjustments and Tests. Connect the oscilloscope probe to pin 10 of J3 and the ground lead to pin 9. Set the potentiometer on the test plug to minimum. Set the MODULATION MODE switch to GRID/PLATE position and the MODULATION SELECTOR switch to the INT. SQ. WAVE 1,000.0 cps position. Adjust the ac line voltage to 115v and turn on the POWER switch. A 200v peak-to-peak square wave should be observed on the oscilloscope. Adjust the symmetry of the square wave by means of potentiometer P2. While observing the oscilloscope, set the potentiometer on the test plug to maximum. A square wave, with no change in symmetry, of at least 300v peak-to-peak should be observed. Next, set the potentiometer on the test plug to minimum and check to see that the rise and decay time of the square wave is less than 5 microseconds. Also, check the rise and decay time of the square wave for jitter.

e. External Modulation Circuit. Connect an external signal generator to the EXT. MOD. FREQ. connector on the front panel. Set the MODULATION SELECTOR switch to the INT. SQ. WAVE EXT. SYNC. 400 - 10,000 CPS position. Set the output of the external signal generator to 400 cycles, 5v rms. Using internal sync. for the scope horizontal sweep, check for jitter of the

square wave. Change the frequency of the external generator to 1,000 cps. Check both jitter and rise and decay time, as before. Set the external generator to 10,000 cps. Again, check for jitter and rise and decay time of the square wave.

f. Repeller Modulation Circuit. Change the scope probe to pin 1 of the test plug and the ground lead to chassis ground. Set the MODULATION MODE switch to REPELLER and the MODULATION SELECTOR to INT. SQ. WAVE 1,000.0 CPS position. Set the REPELLER MOD. ADJ. control on the front panel to maximum. A square wave of 90 to 100v should be observed. Adjust the front panel control for 40v peak-to-peak and check the rise and decay time as before. Set the MODULATION SELECTOR switch to the INT. SQ. WAVE EXT. SYNC. 400 - 10,000 CPS. position. Check the rise and decay time for input frequencies of 400, 1,000 and 10,000 cps. Turn off the HIGH VOLTAGE and POWER switches and disconnect the oscilloscope and the two MS-8 test plugs.

5.2.2. TEST AND ADJUSTMENT PROCEDURES UTILIZING MS-10 TEST PLUGS

a. Install the MS-10 test plugs in J1 and J3. Connect the dc voltmeter between pin 25 (-) of the plug inserted in J3 and chassis ground (+). Turn on the POWER and HIGH VOLTAGE switches and set the input line voltage to 115v. After the high voltage comes on, adjust potentiometer P5 for a reading of -1,000v. Vary the line voltage between 105 and 130v. There should be no discernible movement of the dc meter pointer.

b. Turn off the HIGH VOLTAGE switch, disconnect the dc voltmeter and connect the voltage divider network between pin 25 (high side) and chassis ground. Connect the ac voltmeter across the 10 megohm resistor of the voltage divider.

NOTE

The voltage divider network reduces the dc voltage applied to the voltmeter but, due to the capacitor, the value of the ac ripple and noise component is not reduced.

c. Turn on the HIGH VOLTAGE switch and measure the ac ripple at line voltages of 105, 115, and 130v. Ripple should be less than 4mv rms.

d. Turn off the HIGH VOLTAGE and POWER switches, disconnect the test circuits and the test plugs.

5. 2. 3. TEST AND ADJUSTMENT PROCEDURES UTILIZING MS-11 TEST PLUGS

a. Install the MS-11 test plugs. Connect the dc voltmeter between pin 25 (-) of the plug inserted in J3 and chassis ground (+). Turn on the POWER and HIGH VOLTAGE switches and set the line voltage to 115v. After the high voltage comes on, adjust potentiometer P6 for a reading of -1, 250v dc. Vary the ac line voltage between 105 and 130v. There should be no discernible movement of the dc meter pointer.

b. Turn off the HIGH VOLTAGE switch and disconnect the dc voltmeter. Connect the voltage divider network between pin 25 (high side) and chassis ground. Connect the ac voltmeter across the 10 megohm resistor.

c. Turn on the HIGH VOLTAGE switch and observe the ac voltmeter. Ripple should be less than 3mv rms for line voltages of 105, 115 and 130v.

d. Turn off the HIGH VOLTAGE switch. Connect dc voltmeter (+) to pin 34, (-) to pin 20. Turn on the HIGH VOLTAGE switch, check modulator voltage and regulation. Turn off HIGH VOLTAGE and POWER switches and disconnect the test circuits and test plugs. (Note: Do not check ripple.)

5. 2. 4. TEST AND ADJUSTMENT PROCEDURES UTILIZING MS-22 TEST PLUGS

a. Remove the normal jumper plug from J2 and install the three MS-22 test plugs. Connect the dc voltmeter between pin 25 (-) of the plug inserted in J3 and chassis ground.

b. Turn on the POWER and HIGH VOLTAGE switches and set the line voltage to 115v. Observe the dc voltmeter for an indication of -2, 250v dc $\pm$30v. Vary the line voltage between 105 and 130v. There should be no discernible movement of the dc meter pointer.

c. Turn off the HIGH VOLTAGE switch. Disconnect the dc voltmeter and connect the voltage divider network between pin 25 (high side) and chassis ground. Connect the ac voltmeter across the 10 megohm resistor of the voltage divider.

d. Turn on the HIGH VOLTAGE switch and measure the ac ripple for line voltages of 105, 115 and 130v. The ripple should be less than 4mv rms.

e. Turn off the HIGH VOLTAGE and POWER switches and remove the test circuit and the three MS-22 test plugs. Install the normal jumper plug in J2.

5.2.5 SPECIAL TESTS USING MS-12 TEST PLUGS

The following tests are designed to further check adjustments of the modulator circuits and to provide an initial check of the filament supply.

a. Install the MS-12 test plugs and connect the dc voltmeter between pin 11(+) and chassis ground (-). Set the MODULATION MODE switch to GRID/PLATE position and the MODULATION SELECTOR switch to the CW position.

b. Turn on the POWER and HIGH VOLTAGE switches. The voltmeter should indicate 325v dc $\pm$10 volts. Vary the ac line voltage between 105 and 130v. The indication of the meter should vary less than 1.2%.

c. Replace the dc voltmeter with the ac voltmeter and measure the ripple voltage at line voltages of 105, 115 and 130v ac. Ripple should not exceed 6 mv rms.

d. Disconnect the voltmeter and connect an oscilloscope with the probe to pin 11 and the ground lead to chassis ground. Set the MODULATION SELECTOR switch to INT. SQ. WAVE 1,000.0 CPS. position. A 280v peak-to-peak square wave should be observed. Check to see that the rise and decay times do not exceed 5 microseconds. Also check the jitter of the rise and decay times.

e. Connect the oscilloscope to the SYNC. OUTPUT front panel connector. A sine wave signal having a minimum amplitude of 10v peak-to-peak should be observed. Disconnect the oscilloscope.

f. Connect a dc voltmeter to pin 17(-) and 19(+). A voltage of 5.9 to 6.2v dc (RF Source filament voltage) should be obtained. Next, vary the ac input between 105 and 130v. No discernible movement of the meter pointer should be observed.

g. Replace the dc voltmeter with an ac voltmeter and check for ripple at line voltages of 105, 115 and 130v. The ripple should be less than 10mv rms. Turn off the HIGH VOLTAGE switch and repeat external modulation checks as in MS-8 (Less Repeller Mode), as given in paragraph 5.2.1(e). Turn off the HIGH VOLTAGE and POWER switches.

h. Disconnect all test connectors and test equipment, including the adjustable line voltage transformer. Be certain that the normal jumper plug is installed in J2. The MO-5 is now ready for normal operation.

5.3 POWER SUPPLY STABILITY MEASUREMENT

The power supply stability measurements performed in the preceding paragraphs were made by observing no discernible movement of the dc meter needle. Such a check is adequate for most purposes. However, if it is desired to ascertain the qualitative operation of the MO-5, calibrated laboratory high voltage supplies having regulation and stability substantially better than that of the MO-5 must be utilized to check short-time and long-time stability as well as regulation for varying input line voltages. To perform such regulation and stability tests of the MO-5, utilize a calibrated laboratory standard in accordance with instructions for the particular device in use. DC voltage values and points of measurement can be obtained by referring to the test procedures given in paragraph 5.2. Regulation specifications for these voltages may be found in Table 1.3.

5.4 COOLING AIR FILTER MAINTENANCE

Periodically replace the air filter which is mounted under the grill on the front panel. Refer to the parts list for replacement data for the filter.

5.5 TUBE REPLACEMENT

This instrument was designed to preclude the necessity of tube selection. Should replacement be necessary, refer to the parts list given in Section VI for replacement parts data. After tube replacement, perform the adjustment procedures given in paragraph 5.2.

WARNING

When replacing tubes and other components, observe high voltage precautions. Never change tubes when power is applied to the instrument. To do so may endanger life and may damage the RF Source if it is connected.

5.6 COMPONENT REPLACEMENT

Resistance, capacitance and voltage values are shown on the schematic diagram, Figure 5.6. Standard trouble-shooting procedures such as tube tests, voltage and resistance measurements, will isolate any malfunctions which may occur. When trouble-shooting, operate the MO-5 with a set of test

plugs rather than an RF Source. When replacing components, refer to the parts list given in Section VI to assure that the correct replacement is made. After replacement of parts, perform the adjustment procedures given in paragraph 5. 2. Refer to Figures 5. 1 through 5. 4 for component locations.

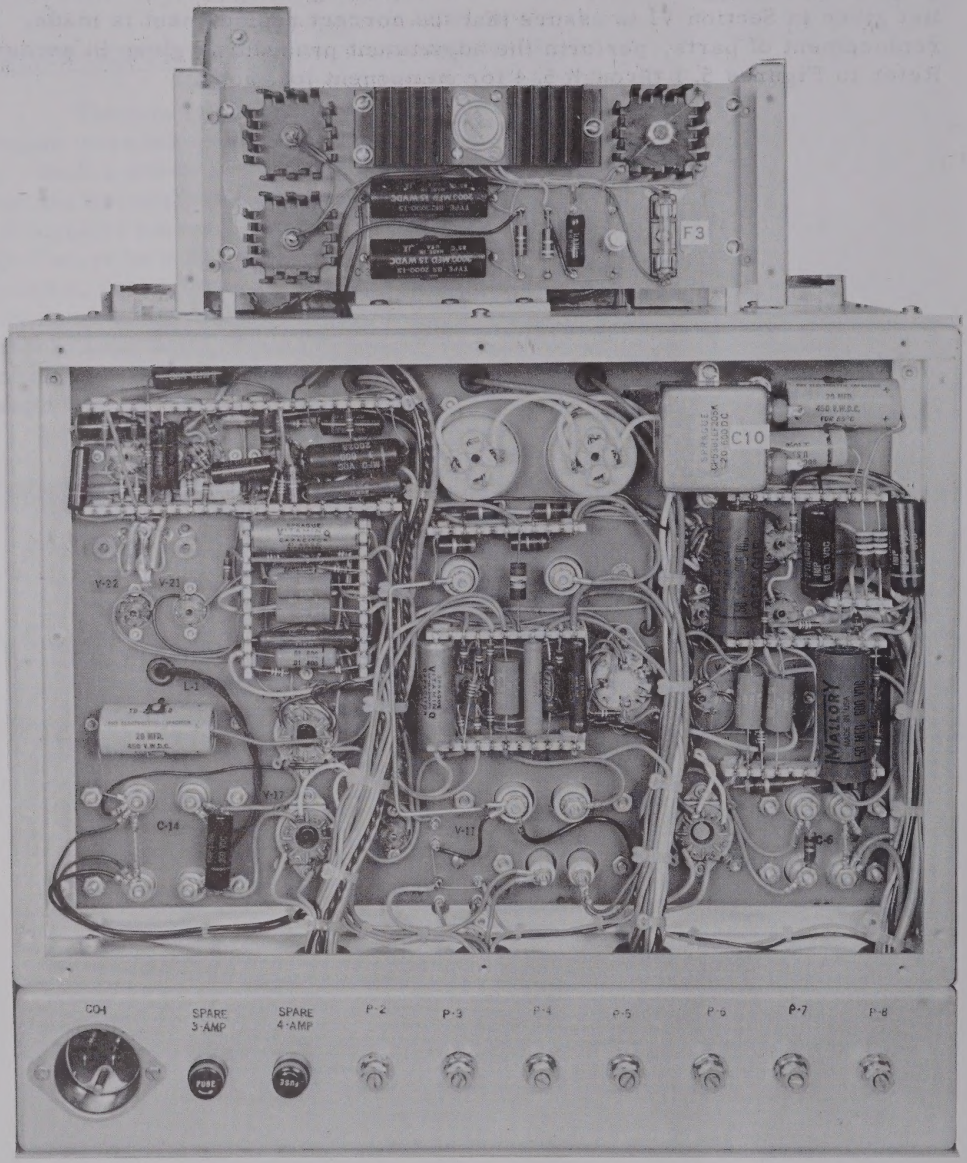


Figure 5.1. Rear View, Model MO-5

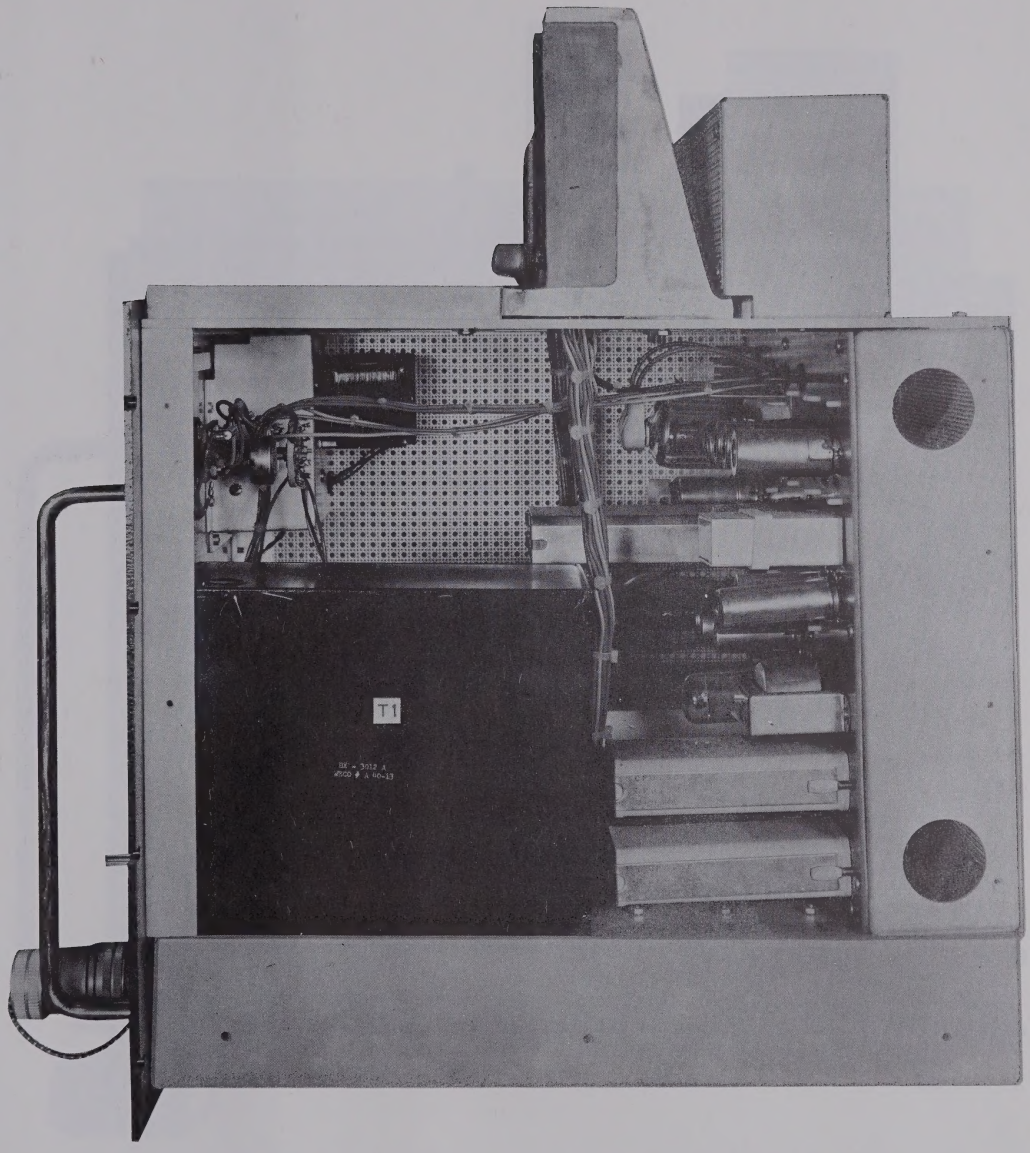


Figure 5. 2. Right Side View, Model MO-5

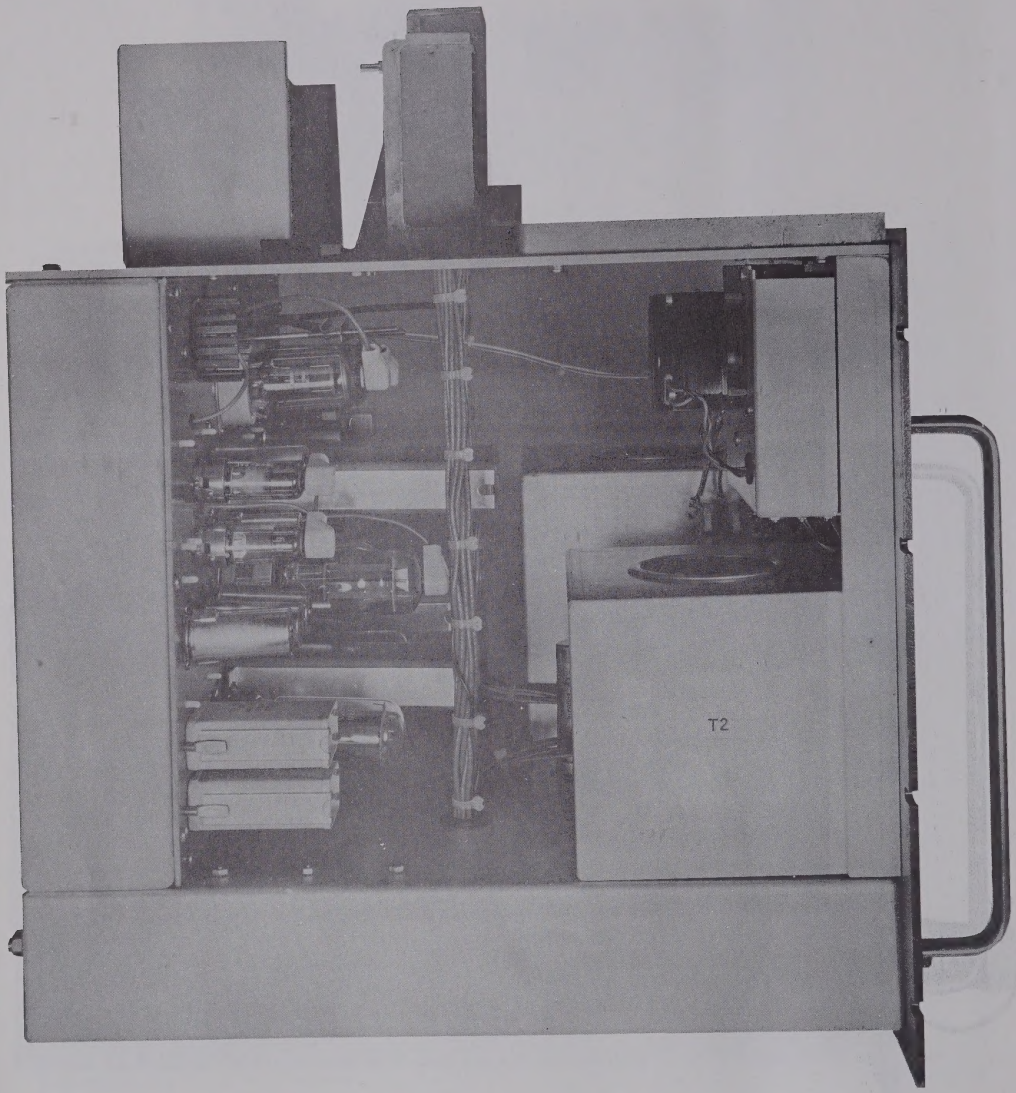


Figure 5. 3. Left Side View, Model MO-5

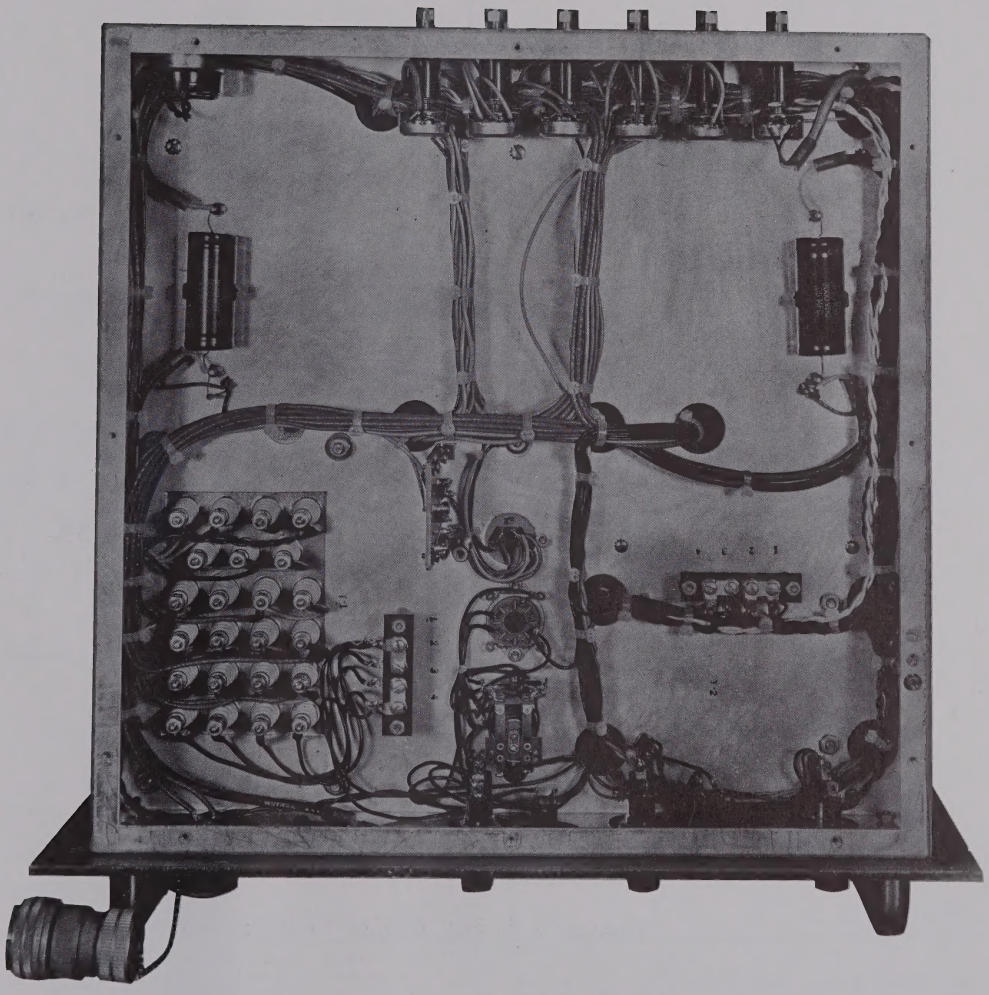


Figure 5. 4. Bottom View, Model MO-5

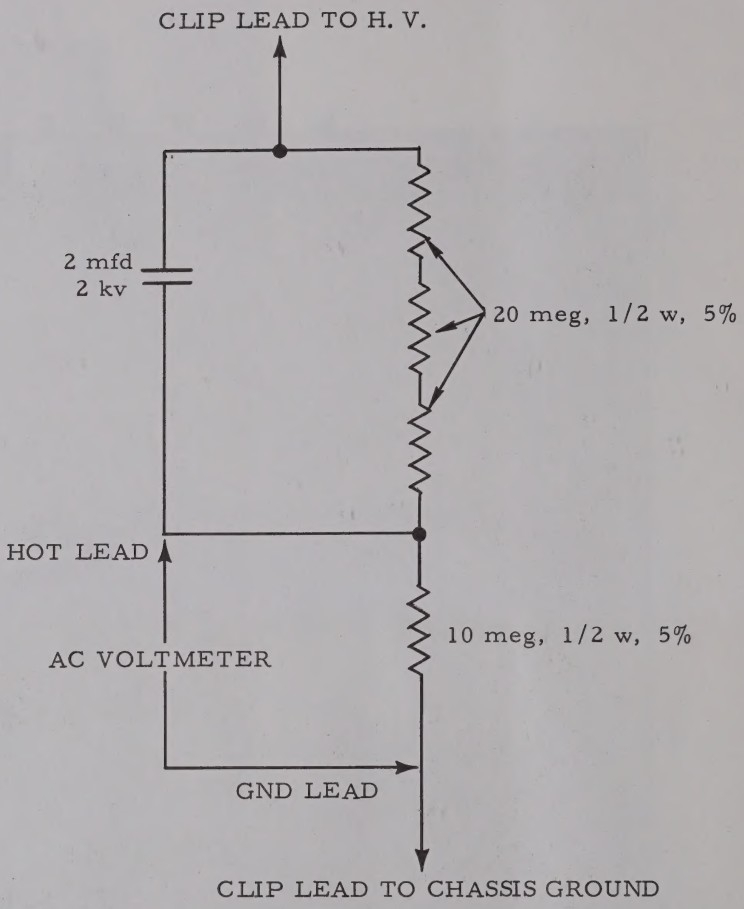
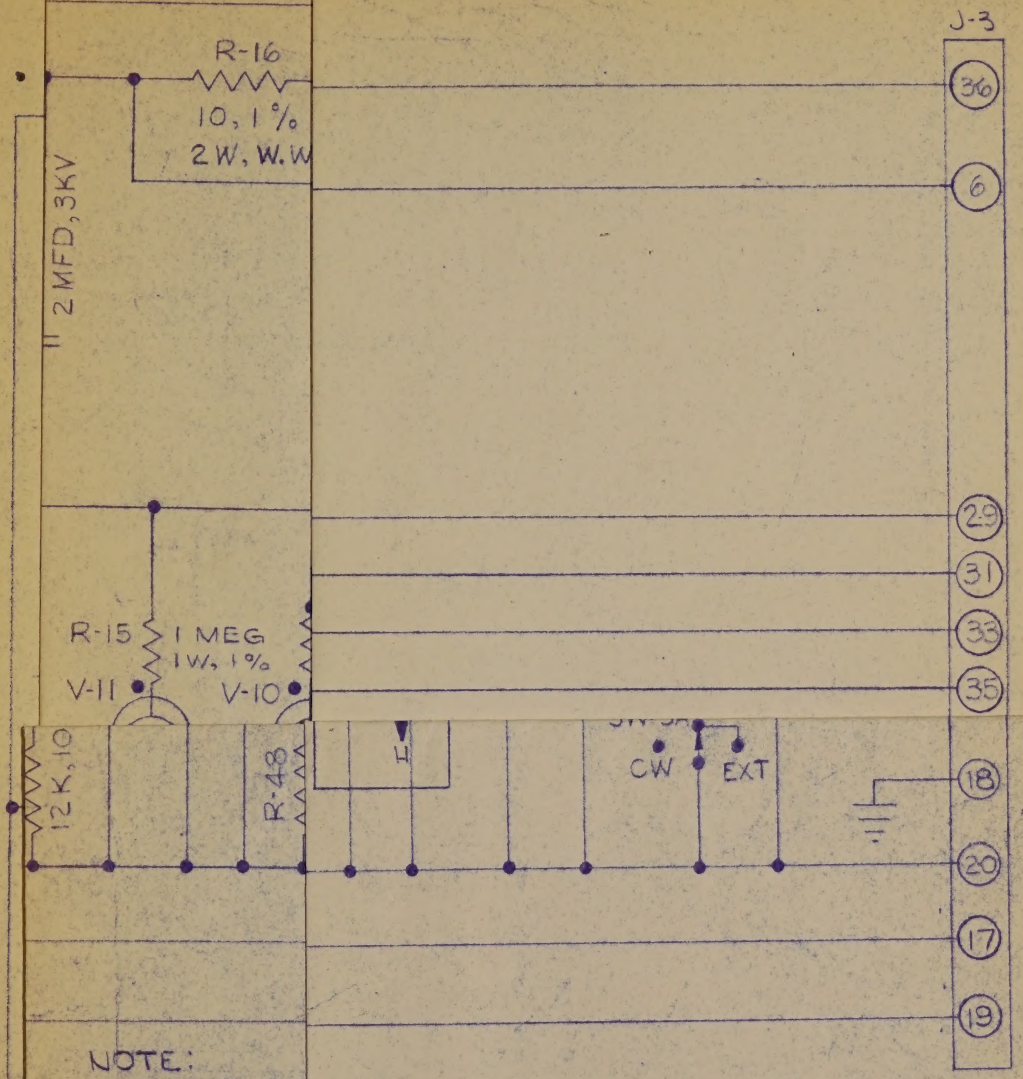


Figure 5. 5. AC Ripple Test Circuit



NOTE:
UNLESS OT
1. ALL CAP
2. ALL RES
3. ALL REI
4. CONNEC
POSITIO
5. CAPACIT
AT FINA

SERIAL NO'S 46 TO 55, 57 & ABOVE

ED ON	ASSY. DRWG.
10-5	

Weinschel Engineering
Kensington, Maryland

SCHEMATIC DIAGRAM MO-5

MATERIAL

FINISH

MENSIONS ARE IN INCHES
TOLERANCES
3 Place Decimal Dims. ±.003
2 Place Decimal Dims. ±.01
Fractional Dims. ±1/64
Angles ±½°
ess Otherwise Specified

D WLG	C BRB	SCALE
10-24-62	10-24-62	
E 14/11/62	A	D129-136

REV F

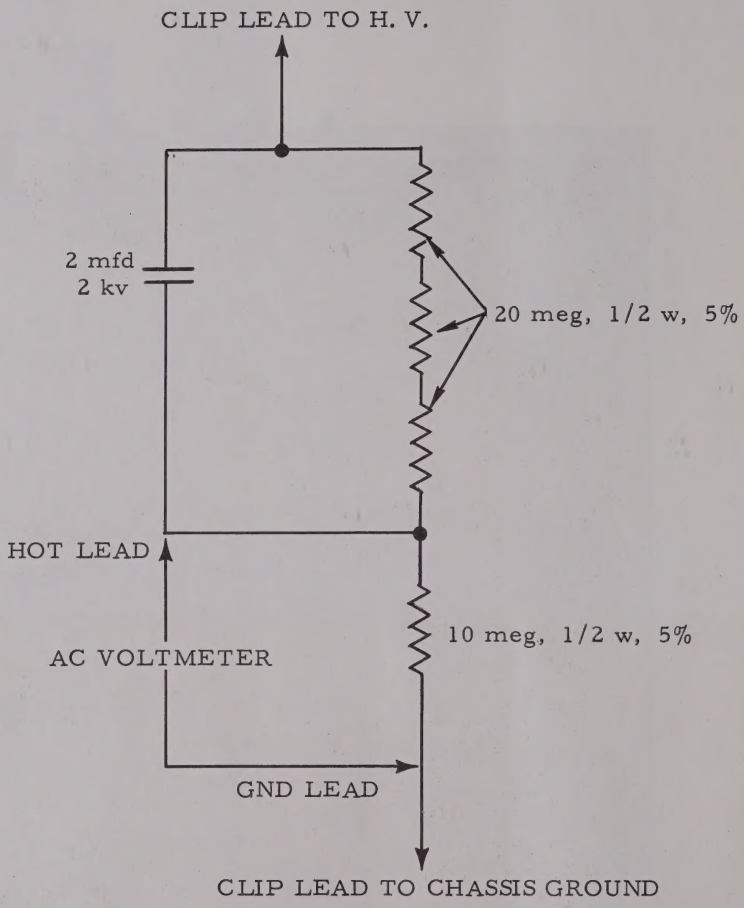


Figure 5. 5. AC Ripple Test Circuit

BEAM SUPPLY

REPELLER SUPPLY

MODULATOR SUPPLY

MODULATOR

HEATER SUPPLY

1000 V COROTRON

1400V COROTRON

800 V COROTRON

NOTE:
UNLESS OTHERWISE SPECIFIED:
1. ALL CAPACITANCES ARE IN MICROFARADS
2. ALL RESISTANCES ARE IN OHMS
3. ALL RESISTORS ARE ½W, 10%
4. CONNECTONS ON TS-1 & TS-2 ARE SHOWN IN 110V POSITION. DOTTED LINES INDICATE 220V POSITION
5. CAPACITORS IN PARALLEL WITH L-1 TO BE INSTALLED AT FINAL TEST.

SERIAL NO'S 46 TO 55, 57 & ABOVE

USED ON	ASSY. DRWG.
MO-5	

Weinschel Engineering
Kensington, Maryland

SCHEMATIC DIAGRAM
MO-5

MATERIAL

FINISH

DIMENSIONS ARE IN INCHES
TOLERANCES
All ± Place Decimal Hdns. ± .005
All ± Place Decimal Hdns. ± .01
All Fractional Hdns. ± 1/64
All Angles ± 1°
Unless Otherwise Specified

D.W.L.G.	C.B.B.	SCALE
10-24-62	10-24-62	
E.M.C. 11/7/62	A	D129-136	F

REVISIONS

	REVISED PER ECO-MO-5	ECN-MO-5-20	1-3-62 AM
	REVISED PER ECO-MO-5	ECN-MO-5-25	5-31-62
	REVISED PER ECO-MO-5	ECN-MO-5-27	8-14-62

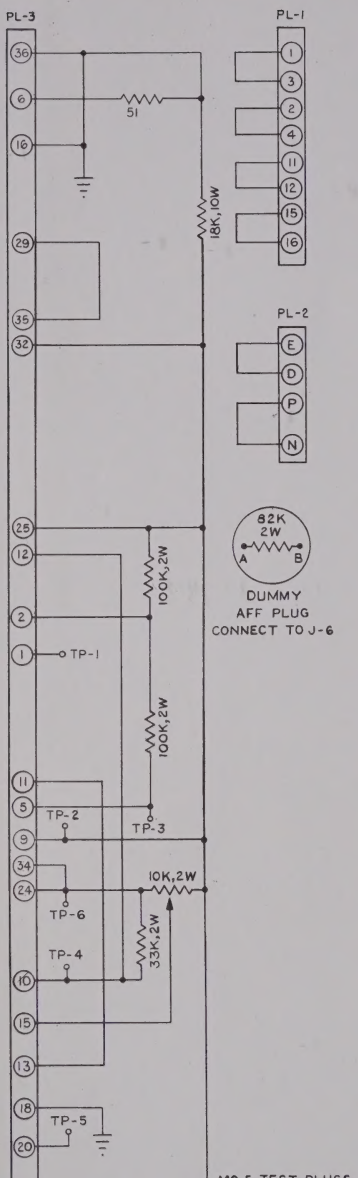


Figure 5.7A. MS-8 Test Plug, Schematic Diagram

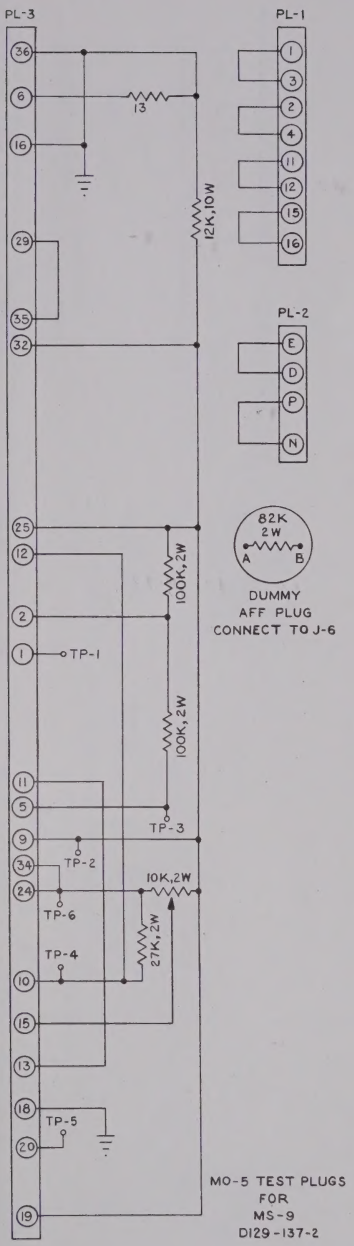


Figure 5.7B. MS-9 Test Plug, Schematic Diagram

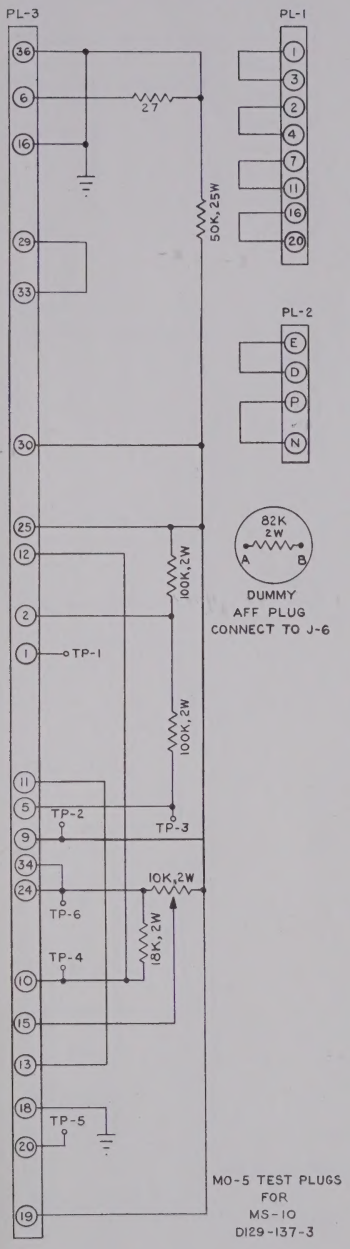


Figure 5.7C. MS-10 Test Plug, Schematic Diagram

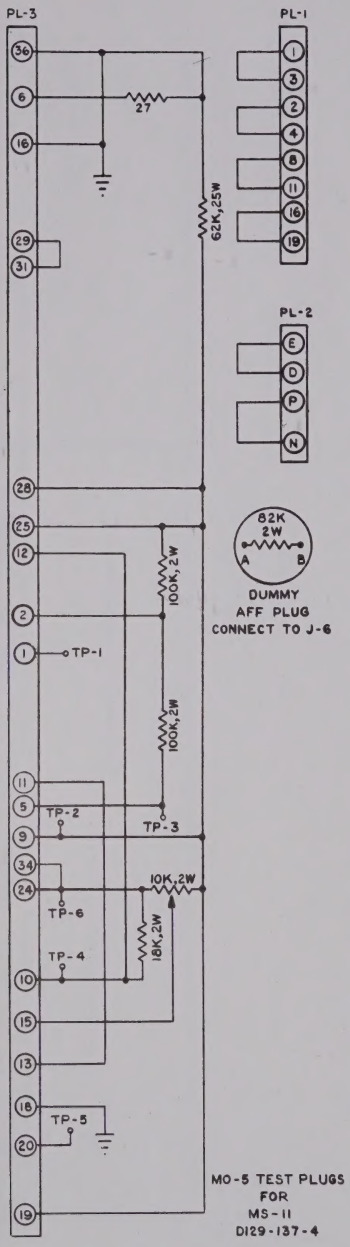


Figure 5.7D. MS-11 Test Plug, Schematic Diagram

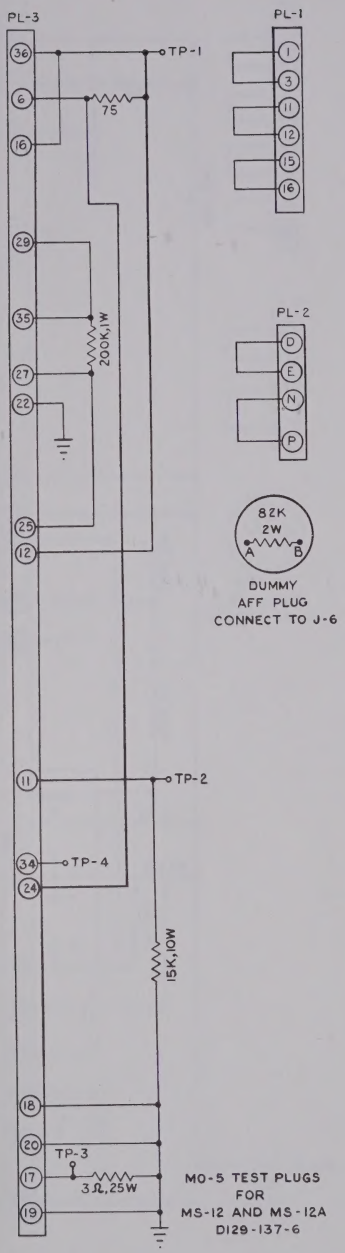


Figure 5.7E. MS-12 & MS-12A Test Plug, Schematic Diagram

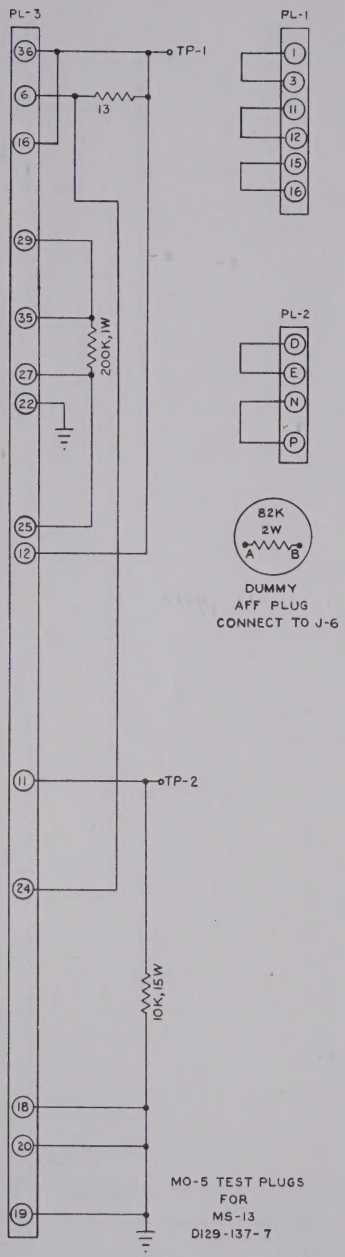


Figure 5.7F. MS-13 Test Plug, Schematic Diagram

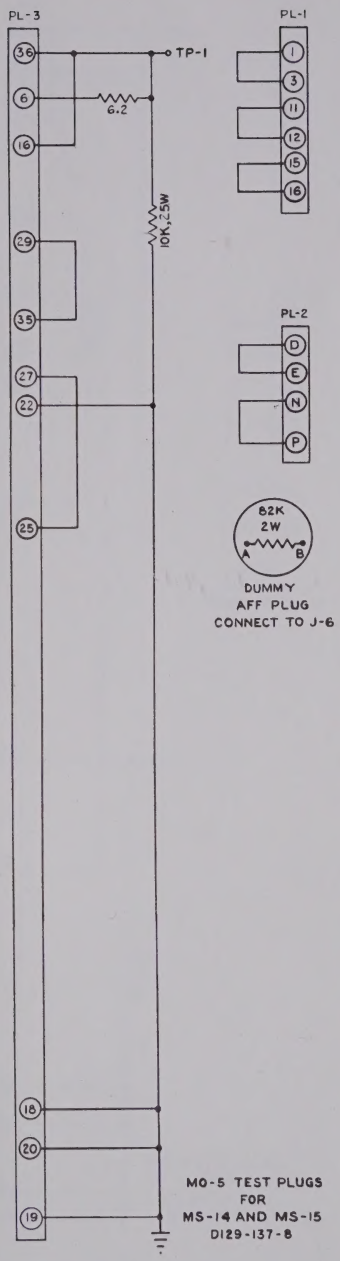
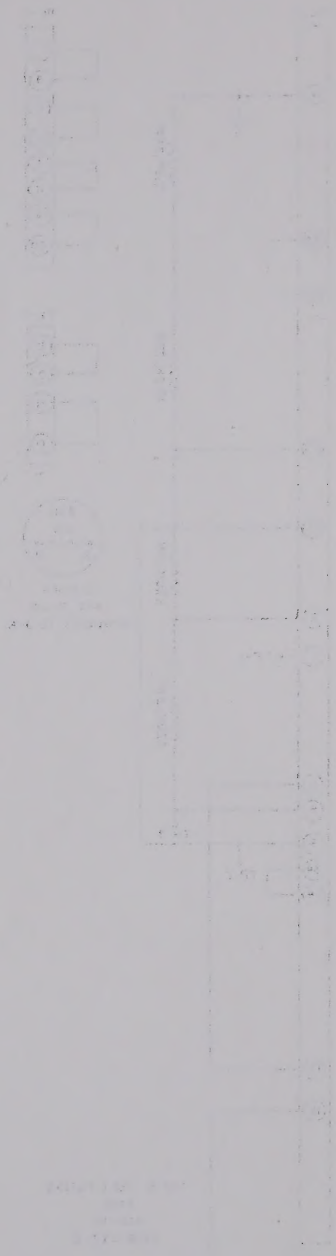


Figure 5.7G. MS-14 & MS-15 Test Plug, Schematic Diagram



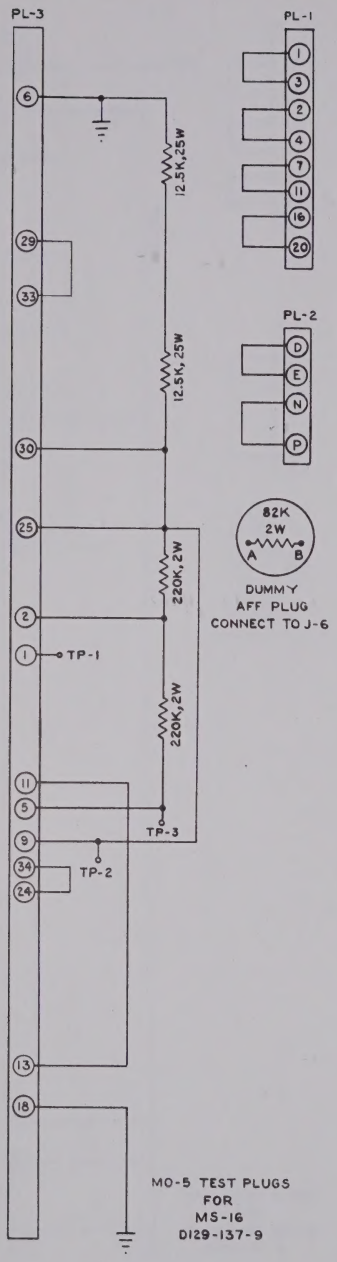


Figure 5.7H. MS-16 Test Plug, Schematic Diagram

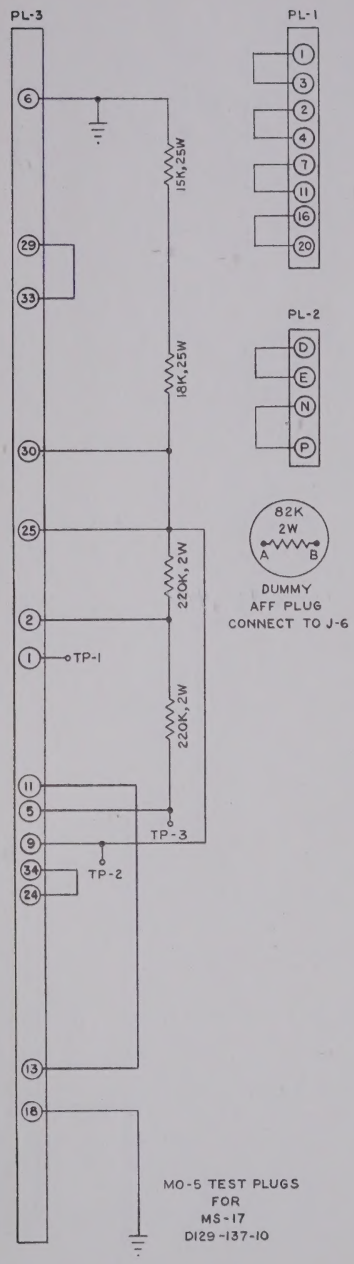


Figure 5.7I. MS-17 Test Plug, Schematic Diagram

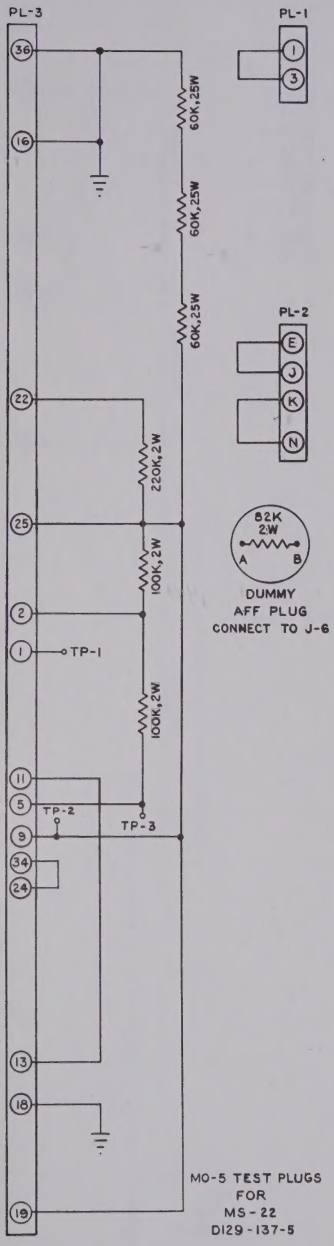


Figure 5.7J. MS-22 Test Plug, Schematic Diagram

SECTION VI

PARTS LIST

6.1 INTRODUCTION

Table 6.1 contains a complete list of all electronic components used in the Power Supply-Modulator, Model MO-5. The first column lists the reference symbol number and is arranged in alpha-numeric order. The second column describes the electrical characteristics of the component, and the last column lists the Weinschel Engineering part number.

6.2 PARTS ORDERING INFORMATION

a. To assure correct equipment operation, order all spare and replacement parts from:

Weinschel Engineering Co., Inc.
Gaithersburg, Maryland

b. To avoid delay when ordering parts, be certain to include:

1. Equipment Model No.
2. Equipment Serial No.
3. Reference Symbol No.
4. Name of part
5. Weinschel Engineering Part No.

Table 6.1. Model MO-5, Power Supply Modulator Parts List

Symbol	Description	Weinschel Part No.
C1	Capacitor: 2 mfd; 5,000v	35-24
C2	Capactior: 47 mfd; 600v; 10%	33-3-R47
C3	Capacitor: .5 mfd; 3,000v	35-26
C4	Capacitor: 2 mfd; 3,000v	35-25
C5	Capacitor: 1 mfd; 1,000v	35-6
C6	Same as C5	
C7	Capacitor, Paper: .01mfd; 600v; 10%	33-3-RO1
C8	Capacitor, Mica: 500 mmf	34-2-500
C9	Same as C2	
C10	Capacitor: 2 mfd; 600v	35-1
C11	Capacitor, Electrolytic: 20 mfd; 450v	31-10
C12	Capacitor, Paper: .1 mfd; 600v; 10%	33-3-R1
C13	Capacitor: 4 mfd; 1,000v	35-3
C14	Same as C13	
C15	Same as C11	
C16	Capacitor, Paper: .01 mfd; 400v; 10%	33-2RO1
C17	Capacitor, Paper: .001 mfd; 400v; 10%	33-2-ROO1
C18	Same as C2	
C19	Capacitor, Paper: .05 mfd; 400v; 10%	33-2RO5
C20	Same as C19	
C21	Same as C7	

Table 6.1 (Cont'd.)

Symbol	Description	Weinschel Part No.
C22	Capacitor, Paper: .05 mfd; 600v; 10%	33-3-RO5
C23	Capacitor, Electrolytic: 10 mfd; 25v	31-13
C24	Capacitor: .05 mfd; 3,000v	35-27
C25	Same as C24	
C26	Same as C19	
C27	Capacitor, Paper: .02 mfd; 600v; 10%	33-3-RO2
C28	Same as C12	
C29	Same as C2	
C30	Same as C12	
C31	Same as C27	
C32	Same as C2	
C33	Same as C16	
C34	Capacitor, Electrolytic: 20 x 20 mfd; 450v dc working	32-16
C35	Capacitor, Electrolytic: 2,000 mfd; 25v	31-35
C36	Same as C35	
CR1	Diode, Zener: IN 1812	12-39
CR2	Diode, Silicon: IN 2071	12-41
CR3	Same as CR2	
CR4	Same as CR2	
CR5	Same as CR2	
CR6	Same as CR2	

Table 6.1 (Cont'd.)

Symbol	Description	Weinschel Part No.
CR7	Diode, Zener: IN 1375	12-40
CR8	Diode, Silicone: IN 1341 RA	12-31
CR9	Same as CR8	
CR10	Diode, Zener: 1.5M6.8Z5	12-27
DS1	Lamp, Indicator, Incandescent: #47	50-1
DS2	Lamp, Indicator, Neon: #NE51H	50-13
DS3	Same as DS1	
E1	Tuning Fork	16-10
F1	Fuse, Cartridge: 3AG; 4 amp; 250v	52-1-4
F2	Fuse, Cartridge: 3AG; 3 amp; 250v	52-1-3
F3	Same as F2	
F4	Same as F2 (spare)	
J1	Connector, Receptacle: 20 female contacts	62-28
J2	Connector, Receptacle: 12 female contacts	62-49
J3	Connector, Receptacle: 36 female contacts	62-30
J4	Connector, Panel Mounting: Type BNC	63-2
J5	Same as J4	
J6	Connector, Receptacle: 2 male contacts	62-46
K1	Relay, Thermal, Time Delay: 15 NO 120	47-2
K2	Relay, Armature, Latching	47-9
L1	Choke: 13h	40-40
M1	Meter, Panel	16-22

Table 6.1 (Cont'd.)

Symbol	Description	Weinschel Part No.
P1	Resistor, Variable: 25,000 ohms, 2w; 10%	20-17
P2	Same as P1	
P3	Resistor, Variable: 50,000 ohms; 2w; 10%	20-1
P4	Resistor, Variable: 250,000 ohms; 2w; 10%	20-45
P5	Resistor, Variable: 1,000,000 ohms; 2w; 10%	20-98
P6	Same as P5	
P7	Same as P3	
Q1	Transistor, Power, Germanium: 2N1038-1	12-42
Q2	Transistor, Power, Germanium: 2N456A	12-26
Q3	Same as Q2	
R1	Resistor, Fixed, Composition: 1,000,000 ohms; 2 w; 10%	25-3-1 meg
R2	Same as R1	
R3	Same as R1	
R4	Same as R1	
R5	Resistor, Fixed, Composition: 220,000 ohms; 1/2w; 10%	25-1-220K
R6	Resistor, Fixed, Composition: 100,000 ohms; 1/2w; 10%	25-1-100K
R7	Resistor, Fixed, Composition: 33,000 ohms; 1/2w; 10%	25-1-33K
R8	Same as R6	
R9	Resistor, Fixed, Composition: 56,000 ohms; 1/2w; 10%	25-1-56K

Table 6.1 (Cont'd)

Symbol	Description	Weinschel Part No.
R10	Resistor, Fixed, Composition: 510,000 ohms; 1/2w; 5%	25-8-510K
R11	Same as R10	
R12	Resistor, Fixed, Wire Wound: 470,000 ohms; 1w; 1%	26-58-470K
R13	Resistor, Fixed, Composition: 120,000 ohms; 1/2w; 10%	25-1-120K
R14	Resistor, Fixed, Composition: 150,000 ohms; 1/2w; 10%	25-1-150K
R15	Resistor, Fixed, Wire Wound 270,000 ohms; 1w; 1%	26-58-470K
R16	Resistor, Fixed, Wire Wound: 10 ohms; 2w; 10%	26-28-10
R17	Resistor, Fixed, Wire Wound: 75,000 ohms; 10w; 5%	26-57-75K
R18	Resistor, Fixed, Wire Wound: 40,000 ohms; 5w; 5%	26-6-25K
R19	Resistor, Fixed, Wire Wound: 135,000 ohms; 10w; 5%	26-57-135K
R20	Resistor, Fixed, Composition: 2,000 ohms; 2w; 5%	25-10-2K
R21	Same as R1	
R22	Same as R1	
R23	Resistor, Fixed, Composition: 680,000 ohms; 1/2w; 10%	25-1-680K
R24	Same as R5	
R25	Same as R9	

Table 6.1 (Cont'd.)

Symbol	Description	Weinschel Part No.
R26	Same as R6	
R27	Resistor, Fixed, Composition: 470,000 ohms; 1/2w; 10%	25-1-470K
R28	Same as R27	
R29	Resistor, Fixed, Composition: 750,000 ohms; 1/2w; 5%	25-8-750K
R30	Same as R12	
R31	Resistor, Fixed, Wire Wound: 68,000 ohms; 1w; 1%	26-58-68K
R32	Resistor, Fixed, Composition: 470,000 ohms; 2w; 10%	25-3-470K
R33	Same as R32	
R34	Same as R27	
R35	Same as R14	
R36	Resistor, Fixed, Composition: 200,000 ohms; 1/2w; 5%	25-8-200K
R37	Resistor, Fixed, Composition: 20,000 ohms; 1/2w; 5%	25-8-20K
R38	Same as R27	
R39	Same as R27	
R40	Resistor, Fixed, Composition: 82,000 ohms; 1/2w; 10%	25-1-82K
R41	Resistor, Fixed, Wire Wound: 270,000 ohms; 1w; 1%	26-58-270K
R42	Same as R-31	

Table 6.1 (Cont'd.)

Symbol	Description	Weinschel Part No.
R43	Resistor, Fixed, Wire Wound: 12,000 ohms; 10w; 5%	26-57-12K
R44	Same as R9	
R45	Same as R5	
R46	Same as R14	
R47	Same as R6	
R48	Resistor, Fixed, Composition: 1,000,000 ohms; 1/2w; 10%	25-1-1M
R49	Resistor, Fixed, Composition: 2,000 ohms; 1/2w; 5%	25-8-2K
R50	Same as R48	
R51	Same as R6	
R52	Resistor, Fixed, Composition: 4,700 ohms; 1/2w; 10%	25-1-4R7K
R53	Same as R48	
R54	Same as R6	
R55	Resistor, Fixed, Composition: 10,000 ohms; 1/2w; 10%	25-1-10K
R56	Resistor, Fixed, Composition: 51,000 ohms; 1/2w; 5%	25-8-51K
R57	Same as R37	
R58	Resistor, Fixed, Carbon Film: 220,000 ohms; 1/4w; 5%	25-13-220K
R59	Resistor, Fixed, Composition: 20,000 ohms; 2w; 5%	25-10-20K
R60	Same as R59	

Table 6.1 (Cont'd.)

Symbol	Description	Weinschel Part No.
R61	Same as R58	
R62	Resistor, Fixed, Composition: 3,000 ohms; 1/2w; 5%	25-8-3K
R63	Same as R7	
R64	Same as R48	
R65	Resistor, Fixed, Composition: 5,600,000 ohms; 1/2w; 5%	25-8-5R6M
R66	Same as R6	
R67	Resistor, Fixed, Composition: 470 ohms; 1/2w; 10%	25-1-470
R68	Same as R67	
R69	Resistor, Fixed, Wire Wound: 25,000 ohms; 10w; 5%	26-57-25K
R70	Same as R48	
R71	Same as R6	
R72	Same as R5	
R73	Same as R27	
R74	Resistor, Fixed, Composition: 270,000 ohms; 1/2w; 5%	25-8-270K
R75	Resistor, Fixed, Wire Wound: 6,000 ohms; 5w; 5%	26-6-6K
R76	Resistor, Fixed, Composition: 270 ohms; 1 w; 10%	25-2-270
R77	Resistor, Fixed, Composition: 390 ohms; 1w; 10%	25-2-390

Table 6.1 (Cont'd.)

Symbol	Description	Weinschel Part No.
R78	Resistor, Fixed, Wire Wound: 50 ohms; 5w; 5%	26-6-50
R79	Resistor, Fixed, Composition: 22,000,000 ohms; 1/2w; ±5%	25-8-22M
SW1	Switch, Interlock	55-13
SW2	Switch, Toggle: D. P. D. T.	55-4
SW3	Switch, Toggle: S. P. S. T.	55-1
SW4	Switch, Rotary: Centralab #2505	56-27
SW5	Switch, Rotary: Centralab #2515	56-28
T1	Transformer, Power	A40-79
T2	Transformer, Filament	A40-80
V1	Electron Tube: 3B24	10-82
V2	Same as V1	
V3	Electron Tube: 807	10-72
V4	Electron Tube: 5751	10-85
V5	Same as V4	
V6	Electron Tube: 5651	10-103
V7	Same as V6	
V8	Same as V6	
V9	Electron Tube: 800v; Corotron, Victoreen	10-128
V10	Electron Tube: 1,000v; Corotron, Victoreen	10-129
V11	Electron Tube: 2,000v; Corotron, Victoreen	10-130

Table 6.1 (Cont'd.)

Symbol	Description	Weinschel Part No.
V12	Electron Tube: 5R4	10-10
V13	Electron Tube: 5814	10-7
V14	Same as V4	
V15	Same as V4	
V16	Same as V6	
V17	Electron Tube: 5U4	10-78
V18	Electron Tube: 6AU5	10-126
V19	Same as V4	
V20	Same as V4	
V21	Same as V6	
V22	Electron Tube 0B2	10-16
V23	Electron Tube: 12AX7	10-69
V24	Same as V13	
V25	Electron Tube: 12AT7	10-67
V26	Same as V13	
V27	Same as V13	
V28	Electron Tube: 7235 Victoreen	10-127
V29	Same as V28	
XDS1	Lampholder	51-4
XDS2	Lampholder	51-7
XDS3	Same as XDS1	

Table 6.1 (Cont'd.)

Symbol	Description	Weinschel Part No.
XF1	Fuse Post, Extractor Type	51-2
XF2	Same as XF1	
XF3	Fuse Clip	51-8
XF4	Same as XF1 (Mounts spare fuse)	
XK1	Socket, Electron Tube: Octal	61-26
XV1	Socket, Electron Tube: 4 pin, ceramic	61-22
XV2	Same as XV1	
XV3	Socket, Electron Tube: 5 pin; ceramic	61-21
XV4	Socket, Electron Tube: 9 pin; miniature	61-3
XV5	Same as XV4	
XV6	Socket, Electron Tube: 7 pin; miniature	61-2
XV7	Same as XV6	
XV8	Same as XV6	
XV9	Not used	
XV10	Not used	
XV11	Not used	
XV12	Same as XK1	
XV13	Same as XV4	
XV14	Same as XV4	
XV15	Same as XV4	
XV16	Same as XV6	

Table 6.1 (Cont'd.)

Symbol	Description	Weinschel Part No.
XV17	Same as XK1	
XV18	Same as XK1	
XV19	Same as XV4	
XV20	Same as XV4	
XV21	Same as XV6	
XV22	Same as XV6	
XV23	Same as XV4	
XV24	Same as XV4	
XV25	Same as XV4	
XV26	Same as XV4	
XV27	Same as XV4	
XV28	Same as XV4	
XV29	Same as XV4	